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ABSTRACT

The objectives of the research reported here were (1) to develop and test the Developmental Sentence Scoring (DSS) technique, a method for quantifying the increasing use of syntactic and morphological structures in the spontaneous speech of children between the ages of three and seven, (2) to establish age norms for syntactic and morphological mastery against which the spontaneous speech of atypical children could be compared, (3) to evaluate a procedure for obtaining a reliable sample of children's spontaneous speech which could be easily used in a school or clinical setting, and (4) to provide information on the normal developmental order of grammatical structures, which could be a guideline for remedial training of children with language problems. The author feels that the DSS technique would be appropriate in establishing accurate baselines for research in language development and in comparing the relative effectiveness of various teaching methods. Its particular value is seen to lie in the fact that it, in contrast to other approaches, assesses the "end product" of language learning, the child's actual performance in verbal communication with the adult world. (Author/FWB)

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DEVELOPMENTAL SENTENCE SCORING:

A METHOD OF QUANTIFYING THE DEVELOPMENT OF SYNTAX AND MORPHOLOGY IN CHILDREN'S LANGUAGE

Laura L. Lee
Northwestern University
Evanston, Illinois 60201

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SUMMARY

The objectives of this research were (1) to develop and test the Developmental Sentence Scoring (DSS) technique, a method for quantifying the increasing use of syntactic and morphological structures in the spontaneous speech of children between the ages of three and seven, (2) to establish age norms for syntactic and morphological mastery against which the spontaneous speech of atypical children could be compared, (3) to evaluate a procedure for obtaining a reliable sample of children's spontaneous speech which could easily be used in a school or clinical setting, and (4) to provide information on the normal developmental order of grammatical structures, which could be a guideline for remedial training of children with language problems.

The Developmental Sentence Scoring technique assesses children's syntactic development from a corpus of fifty spontaneously-formulated sentences by giving weighted scores to a developmental progression of (1) indefinite pronouns, (2) personal pronouns, (3) main verbs, (4) secondary verbs, (5) negatives, (6) conjunctions, (7) interrogative reversals, and (8) wh-questions. Each sentence is scored for these eight linguistic features, and the mean score per sentence is derived. This number is called the Developmental Sentence Score (DSS).

The Developmental Sentence Scoring technique was carried out on 160 children between ages 3-0 and 6-11. All the children were from monolingual homes where standard English dialect was spoken. All the children except two came from middle-income families, and all of them scored between 85 and 115 on the Peabody Picture Vocabulary Test. Five boys and five girls were selected for each 3-month age group, thus assuring equal representation by sex and equal distribution of ages within a 6-month age group. An attempt was made to keep the recording sessions as uniform as was possible in a spontaneous conversational setting by presenting all the children with the same toys, pictures, and story-telling stimulus materials. The large majority of tapes were made by the Research Assistant on this project, but a few were done by three other persons. All the interviewers were trained speech pathologists at the Master's level, and they attempted to duplicate in this research setting the kind of child-clinician conversation which is traditional in speech clinic teaching.

The last fifty sentences that each child formulated were selected as the corpus to be scored by the Developmental Sentence Scoring technique. Mean DSS scores were computed for the 10 boys and 10 girls separately in each 6-month age group. Boys' scores were consistently lower than girls' except in the lowest age group. The gap appeared

to widen with age and was greatest in the 6-0 to 6-5 age group. Both boys and girls showed a similar plateau in performance at the age of 5-6 to 5-11. Percentiles were computed for the combined group of boys and girls, 160 children in all, for the 90th, 75th, 50th, 25th, and 10th percentiles, at 6-month age intervals. The score distributions within each age group were fitted to normal curves and percentile values were then computed from the normalized distributions. These percentiles provided a set of norms against which the slowly-developing language of atypical children could be compared.

A reliability check on the Developmental Sentence Scoring technique was made by 24 speech pathology students in a graduate level course in language development. Each student was given a different tape, randomly selected from the research collection. Each student made his own transcription and selected his own corpus of the last fifty sentences for DSS scoring. The mean discrepancy between the 24 students' scores and the 24 research scores was approximately 3%. Thus, the Developmental Sentence Scoring technique seemed to be a reliable procedure which could be learned and applied effectively by speech clinicians.

The DSS technique would be appropriate in establishing accurate baselines for research in language development and in comparing the relative effectiveness of various teaching methods. Its particular value lies in the fact that it assesses the "end product" of language learning, the child's actual performance in verbal communication with the adult world.

BACKGROUND FOR THE STUDY

The identification of children with language problems is important both in schools and in speech clinics. Reading readiness programs, language arts curricula, and language development training for culturally disadvantaged, mentally retarded, hearing impaired, perceptually handicapped children, etc. would greatly benefit from information concerning the developmental sequence of grammatical growth in normal children. Teaching methods, both in classrooms and in clinics, would be improved if it were known in what order and at what ages specific syntactic and morphological features of language are developed by normal children. An accurate procedure for measuring the grammatical sophistication of a child's spontaneous speech would help both in identifying the atypical child and in measuring his progress throughout language training. The Developmental Sentence Scoring technique has been devised to provide such an instrument for measuring syntactic development in children.

Older methods of judging language growth in children emphasized length of utterance with little attention to syntactic complexity (Templin, 1957). The separation of sentences into simple, compound, and complex did not consider such elements of syntax as pronouns, verb tenses, negatives, and questions. Elaborate psycholinguistic studies on the language development of a few children (Bloom, 1968; Brown and Fraser, 1964; McNeill, 1966) have yielded valuable information on the growth of syntactic structures, employing Chomsky's (1957, 1965) transformational grammar as an analytical instrument. However, the psycholinguist's technique of writing an individual grammar for each child at each stage of development is not easily adaptable to the needs of language teachers.

Many measures of syntactic and morphological development, such as Berko's (1958), The Grammatic Closure subtest of the Illinois Test of Psycholinguistic Abilities (Kirk, McCarthy, and Kirk, 1968), and the Northwestern Syntax Screening Test (Lee, 1969), while effective as quick screening tests, have limited usefulness in predicting a child's performance in spontaneous speech. Such tests are based on highly selected items presented in single-sentence tasks. However, in spontaneous speech a child may be inconsistent in his use of the very forms which he accomplished within the structured simplicity of the test. Conversational speech places a "transformational load" upon a child's performance which cannot be evaluated by selective testing. Thus, a child who could correctly formulate the past tense, it fell down, as a test item, might revert to the uninflected verb if he were trying to formulate a sentence with a heavy "transformational load," such as, why didn't you tell me that it fell down? A comprehensive assessment of syntax development must account not only for a child's accuracy with single items but also his consistency and frequency of usage

and his ability to combine many transformations into a single sentence in spontaneous speech. For these reasons the speech sampling and scoring technique provides a more thorough evaluation of a child's grammatical performance than can be obtained from standardized tests.

Many studies using tape-recorded speech samples have reported the development of particular syntactic structures in a small number of children. Cazden (1968) investigated the development of noun and verb inflections and also employed a scoring system for early noun phrase and verb complexity (1965). Klima and Bellugi (1966) studied the development of negatives and questions. Brown (1968) reported on the development of wh-questions. Carol Chomsky (1969) investigated children's ability to comprehend the base structures of sentences involving infinitives. Menyuk's (1969) analysis of the syntax of three- to seven-year-old children covered a wide range of both base and transformational structures. These psycholinguistic investigations have generally been concerned with the development of linguistic competence, the child's gradual generalizing of syntactic and morphological rules. A corpus of utterances was analyzed, usually be means of transformational grammar, to determine a single child's grammatical rules and their modification at successive stages of his development.

By contrast, Developmental Sentence Scoring evaluates a child's performance, his use of grammatical rules in spontaneous speech, and measures the child's grammar against adult "standard" English. A child is not scored correct unless he has met all the syntactic and morphological requirements of the structure he is using. No intermediate steps are credited. A child who shows consistent accuracy in his performance with a particular syntactic structure may be assumed to have generalized a "standard" rule at the deeper level of competence. However, errors on Developmental Sentence Scoring merely reduce the child's overall score without indicating what erroneous generalizations he was making. This kind of further psycholinguistic analysis of a child's deviations from adult grammar should be made by the clinician to gain the maximum benefit from the sampling and scoring procedure, but it is not an integral part of the procedure itself. Developmental Sentence Scoring uses some of the findings from psycholinguistic research in suggesting what might be a normal progression of syntactic development, but it also employs more traditional terminology and grammatical classifications. It also makes extensive use of findings from the study of syntax development in the children enrolled at the Northwestern University Speech Clinic.

METHOD

CASE SELECTION

The Developmental Sentence Scoring technique was carried out on 160 children between ages 3-0 and 6-11. All the children were from monolingual homes where standard English was spoken, and all except two came from middle-income families, as judged by fathers' occupations, classifications 3, 4, and 5 on the 7-point Warner scale (Warner, Meeker, and Eells, 1949). All children obtained IQ scores between 85 and 115 on the Peabody Picture Vocabulary Test. Five boys and five girls were selected for each 3-month age group, thus assuring equal representation by sex and equal distribution of ages within a 6-month age group.

THE RECORDING SESSION

An attempt was made to keep the recording sessions as uniform as was possible in a spontaneous conversational setting. The children were first shown three sets of toys, a small barn and farm animals, a transport truck with removable cars, and a doll family with some plastic doll furniture. They were invited to play with the toys and to talk about them. The children were next asked to tell about a set of pictures chosen from the pre-primer series, We Read Pictures, We Read More Pictures, and Before We Read (Robinson, Monroe, and Artley, 1962). The children were finally asked to tell the story of The Three Bears, using the pictures from What's Its Name? (Utley, 1950) as a guide, if they wished. The adult interviewer did not direct the conversation but interacted verbally with each child sufficiently to elicit as "high level" grammatical sentences as he was able to give. All interviewers were trained speech pathologists at the Master's degree level, and they attempted to duplicate in this research setting the kind of child-clinician conversation which is traditional in clinical teaching. The great majority of tapes were made by a single person, the Research Assistant on this project, but three other Master's level people each made a few. Recording sessions varied in length from 15 to 30 minutes, depending upon the talkativeness of the child.

SENTENCE SELECTION

Recognizing the value of a "warm-up" period and also recognizing the possibility that pictures and stories might elicit more sophisticated language than free play, the last fifty sentences

that each child formulated were selected as the corpus to be scored. The criteria for sentence selection were that they should be complete, different, consecutive, intelligible, and spontaneously formulated rather than echolalic.

1. A sentence was judged as complete if it had at least a noun and a verb in subject-predicate relationship. In cases where a child gave a grammatical fragment followed by an independent clause, the fragment was omitted, but the independent clause was counted: (over there, but) it's too far away. However, if the fragment was followed by a dependent clause, none of it was included in the speech sample: (the place where you look out). Imperatives were counted as complete sentences: open your eyes.

2. Repeated sentences were excluded from the sample to avoid overused stereotypes, such as, I don't know and what's that?

3. Consecutive sentences were used to avoid selecting only high-scoring utterances and to obtain a more representative sample of a child's conversational speech.

4. Intelligibility was closely judged so that a child was not penalized for articulation errors nor credited with things he did not say. Sentences were excluded from the sample if any potentially scorable parts of them could not be understood. The appearance of an unintelligible sentence did not require the examiner to start over in his counting to derive the fifty consecutive sentences; he merely omitted these unqualified sentences as he continued to count. Prosodic features, such as intonation, stress, and rhythm, were used as cues in determining exactly what grammatical structures a child had formulated, whether he pronounced them accurately or not. Careful attention was given to the context in which the speech occurred as further clue to its grammatical structure, meaning, and appropriateness.

5. Echolalic utterances were excluded from the sample since they did not reveal the child's own use of grammatical rules. However, if the child changed the adult sentence in any way, he was credited with having formulated it himself. The adult was encouraged to use syntactic structures slightly more advanced than those the child was using to see if he would "pick them up" and use them himself.

THE SCORING SYSTEM

Scoring every individual grammatical feature of a child's language sample would be so time-consuming as to be clinically impractical. Therefore, only eight features were selected, based upon their early appearance in children's language and their developmental progression, which allowed weighted scores to be assigned to later-developing forms. In this model of syntax development it was assumed that the child was learning "standard" English. Considerable modification would have to be made for use with children learning dialects; indeed, an entirely new scoring system would have to be devised.

The scored items included (1) indefinite pronouns and/or noun modifiers, (2) personal pronouns, (3) main verbs, (4) secondary verbs, (5) negatives, (6) conjunctions, (7) interrogative reversals, and (8) wh-questions. Within each classification, specific words or structures were grouped into what was believed to be a general developmental order. The scoring procedure would have become unmanageable if a different score had been assigned to each specific grammatical item. By grouping together words or structures of presumably similar degrees of difficulty, the highest scores in any of the classifications were kept between 5 and 8.

The Sentence Point

Many important grammatical features were omitted from the Developmental Sentence Scoring system: the use of articles, plurals, possessive markers, prepositional phrases, adverbs, word order, word selection, etc. To account at least in part for these non-scored items, an additional "sentence point" was added to the total sentence score if the entire sentence was correct in all respects. Thus, sentences such as the following would not receive the sentence point even though the errors they contain are not in any of the scorable classifications: he went in house, he saw two mans, that is Daddy coat, he took off it, he footed the ball.

Indefinite Pronouns or Noun Modifiers

Score	Examples
1	it, this, that
2	no, some, more, all, lot(s), one(s), two, three (etc.), other, another
3	something, somebody, someone
4.	nothing, nobody, no one, none
5	any, anything, anybody, anyone every, everything, everybody, everyone
6	both, few, many, each, several, most, least, much, next, first, last, second (etc.)

The assigned score was given for these words whether they were used alone as pronouns, I want this, or as noun modifiers, I want this cookie.

Personal Pronouns

Score	Examples
1	I, me, my, mine, you, your(s)
2	he, him, his, she, her, hers
3	we, us, our(s), they, them, their
4	those, these
5	myself, yourself, himself, herself, itself, themselves
6	Wh-pronouns: who, which, whose, whom, that, what, how many, how much. I know who came. That's what it is. Wh-word + infinitive: I know what to do.
7	(his, my, etc.) own, one, oneself, whichever, whatever

Many considerations go into proper pronoun selection: person number, gender, and case. A child was not given credit unless his pronoun selection met all these adult requirements. Early use of personal pronouns seems to begin with the speaker-listener distinction; therefore, first and second person pronouns were placed first on the list. Third person and plural pronouns were given higher scores.

The wh-pronouns introduce second kernel sentences which may be complements of the first kernel, I know who came and that's what I said. The wh-pronouns are similar to another set of wh-words which have been classified as conjunctions: where, how, when, etc. However, the wh-pronouns are integral parts of the second kernel sentence. In the sentence, I know who came, who is the subject of the second kernel; in the sentence, that's what I said, what is the object of the second kernel. By contrast, in the wh-conjunction sentence, I know where he is going, where fills a conjunction slot between the two kernels, I know and he is going. Since these two sets of words, wh-pronouns and wh-conjunctions, are so similar, the scoring was worked out to give both of them the same weight (score 6). The same confusion could also arise in regard to the wh-word + infinitive constructions. Wh-pronouns + infinitive have the wh-word as the object of the infinitive: I know what to do and I know which to choose. However, in the wh-conjunction + infinitive construction, this object relationship does not exist: I know how to do it and I know where to go. If the clinician confuses these two sets of wh-words, the overall score will not be affected since they both score 6; they will merely be credited to the wrong classification.

The last set of pronouns was included to account for further growth into more adult forms. Children use the construction, my own, his own, and their own, but the use of whatever would be rare. This group of words is included merely to suggest that there is further development and to allow for the scoring of words which have not as yet been found in children's speech samples.

Main Verbs

Score	Examples
1	Uninflected verb: I see you.
	Copula, is or 's: It's red.
2	is + verb + ing: He is coming.
3	-s and -ed: plays, played He wants it. I wanted it.
	Irregular past: ate, saw He ran away. I went home.
	Copula + inflections: am, are, was, were He was here.
	Auxiliary am, are, was were He was going.
4	can, will, may + verb: may go, can see I can swim.
	Obligatory do + verb: don't go Do you see it?
	Emphatic do + verb: I do see. I do want it.

(cont.)

Score	Examples (cont.)
5	could, would, should or might + verb: I might come. It could be. He should go.
	Obligatory does, did + verb: Does it hurt? Did he go?
	Emphatic does, did + verb: It does hurt. He did go.
6	must, shall + verb: He must come. We shall see.
	have + verb + en: I've eaten it. He has seen me.
	have ('ve) got: I've got it.
7	Passive, any tense: A movie was shown. He got hurt.
8	have been + verb + ing: I have been walking.
	had been + verb + ing: They had been hiding.
	modal + have + verb + en: They may have eaten it.
	modal + be + verb + ing: They could be playing.
	Three-auxiliary combinations: You should have been sleeping. He might have been going home.

The auxiliary verb system is one of the most complicated features of English. Traditional names for verb tenses are of little value in explaining children's acquisition of verb forms. Verb tense development can best be traced by means of Chomsky's (1957, p. 111) schema, which represents the privilege of occurrence for auxiliary verbs in adult "standard" English:

C (M) (have + en) (be + ing) V

The first item, C, represents the past or present tense, an obligatory choice, which is always attached to the first of whatever auxiliary verbs are used. If only the lexical verb is used, then the tense markers are placed as word endings on the lexical verb itself, usually taking the form, -s, on third person singular present tense and -ed on regular past tense verbs. Future tense is not included in the item, C, since future is marked by a modal verb, will, in English. The second item, (M), is the set of five modal verbs, can, will, may, shall, and must, which appear in parentheses, because their use is optional. If modals are used, they have an initial privilege of occurrence among the auxiliaries. The next item, (have + en), an optional choice, shows that the verb ending, en, is added in the same operation as the auxiliary, have, although it appears morphologically on the following verb, whether it be an auxiliary or the lexical verb. The next item, (be + ing), another optional choice, also adds the verb ending, ing, to the next verb, in this case, the lexical verb itself. Combinations of these rules produce all the verb tenses of English.

In Developmental Sentence Scoring verb forms have been classified according to the order in which children incorporate the various parts of Chomsky's schema into their own grammatical systems. The transformations, obligatory do and emphatic do, are also included in the classifications, with the inflected does and did receiving a higher score than the simpler do. The switching of present and past tense markers from the lexical verb to the do

is a complicated operation for many children; they may attempt such formulations as he don't goes, do he fell down?, and he didn't saw me. The rule which they have not yet generalized is the placement of the tense marker, Chomsky's C, on the first verb in the string.

Secondary Verbs

Score	Examples
1	Five early-developing infinitival complements: I wanna see (want to see) I'm gonna see (going to see) I've gotta see (got to see) lemme [to] see (let me [to] see) let's [to] play (let [us to] play)
2	Non-complementing infinitives: I stopped to play. I'm afraid to look.
3	Participle, present or past: I see a boy running. I found the toy broken.
4	Early infinitival complements with differing subjects in kernels: I want you to come. Let him [to] see. Later infinitival complements: I had to go. I told him to go. I tried to go. I asked you to go. Obligatory deletions: Make it [to] go. I'd better [to] go. I heard the bell [to] ring. Infinitive with wh-word: I know what to get. I know how to do it.
5	Passive infinitival complement: I have to get dressed. I want to be pulled.
6	Gerund: Swinging is fun. I like fishing.

Secondary verbs occur when two kernel sentences are combined by transforming the second kernel verb into an infinitive, participle, or gerund. While some secondary verbs carry tense, they do not follow the auxiliary system that Chomsky schematized for main verbs. The earliest of these secondary verb forms, an immature infinitival complement, often appears even before sentence structure is complete: wanna see it, gonna take it out. It is doubtful that a child at this pre-sentence stage has formulated these structures as real infinitival complements, especially since they are articulated as contracted forms: wanna, gonna, gotta, lemme, and let's. Only these five verbs were included in the first group of infinitival complements since they appear so early.

If the second kernel sentence had a different subject from the first kernel, then infinitival complements with these five early-developing forms were scored as grammatically formulated structures: I want you to come and let him [to] see. Certain verbs require the deletion of the to in the infinitive: I made it [to] go and I heard the bell [to] ring. These forms were scored as later-developing infinitival complements. Passive infinitives were scored higher than any other infinitive forms. Gerunds, which change verbs to nouns by the addition of ing and the placement in a noun position, were scored highest of all the secondary verbs.

Negatives

Score	Examples
1	it, this, or that + copula or auxiliary is or 's + not: It's not mine. This is not a dog. That is not moving.
2	can't, don't
3	isn't, won't
4	Any copula-negative or auxiliary-negative contraction other than # 1, 2, 3, or 5: They aren't here. I couldn't go. They weren't watching.
	Any pronoun-auxiliary contraction + not, other than # 1 or 5: You're not going. He's not here.
	Any uncontracted negatives, other than # 1 or 5: I can not go. I should not go. I am not going.
5	Negatives with have:
	Uncontracted negative: I have not eaten it.
	Auxiliary have-negative contraction: I hadn't eaten it.
	Pronoun-auxiliary have contraction: I've not eaten it.

The first group of negative constructions involved the insertion of not in a sentence where the subject was one of the three earliest indefinite pronouns: it is not, this is not, and that is not. The second and third groups, can't, don't and isn't, won't, seem to be used by children as a set of negative words rather than as grammatically formulated negative transformations, since they use the negative forms considerably before they use their affirmative counterparts. After these stages, the negative rules are learned sufficiently to allow the proper insertion of not after the first auxiliary or to contract it with the pronoun or the auxiliary. The remaining auxiliary, have, is so late appearing that its negative forms comprise a separate group.

To an extent, the higher negative scores are a result of higher main verb scores. Yet it presumably requires greater grammatical skill to manipulate the optional contractions of auxiliary with negative or pronoun with auxiliary when the auxiliary system has become highly elaborated. Even without the complication of contractions, just the insertion of not requires the child to find its proper location after the first auxiliary. This greater "transformational load" justifies the weighted scores for negatives as well as for the main verbs.

Conjunctions

Score	Examples
1	and
2	but
3	because
4	so, and so, so that, if
5	or, except, only

(cont.)

Score	Examples (cont.)
6	where, when, while, why, how, whether (or not), for, till, until, since, before, after, unless, as, as + adjective + as, as if, like, that, than: I know where you are. I see why you want it. Obligatory deletions: I can run faster than you [can run]. I am as big as a man [is big]. Wh-words + infinitive: I know how to do it. I know where to go.
7	therefore, however, whenever, wherever, etc.

Since there is no grammatical constraint on the endless use of conjunctions, special rules had to be created to avoid deceptively long, high-scoring sentences. Sentences which began with conjunctions were counted as complete sentences, but the conjunctions were not scored:

1. (Because) I wanted it.
2. (But) I saw them.
3. (And) then we came home.

Only one and conjunction per sentence was allowed when the and connected two independent clauses. Sentences were broken up as follows:

1. I came home and my dad was there...
2. (and) he saw my dog and he started laughing...
3. (and) the dog got scared and he started to bark.

And used in a series or compound subject or predicate was always counted and did not require the sentence to be broken up:

1. I like red and blue and green and yellow.
2. My brother and sister came and we went out and played...
3. (and) it began to rain and get cold and we came home and played.

Internal conjunctions, other than and, did not require the sentence to be broken up:

1. He came back and we played but we got tired so we quit...
2. (and) then we had lunch and some kids came over but we didn't like them...
3. (and) we told them to go home so they went.

This treatment was occasionally given to other overused conjunctions:

1. (So) they wanted a dog so they told their dad...
2. (so) their dad said they could have one so they went to the pet shop.

Interrogative Reversals

Score	Examples
1	Reversal of copula: Is it red? Were they there?
2	Reversal of auxiliary be: Is he coming? Are they going? Were they running?
3	Obligatory do, does, did: Do they run? Does it bite?
	Reversal of modal: Can you play? Shall I sit down?
	Tag question: It's fun, isn't it? It isn't here, is it?
4	Reversal of auxiliary have: Has he seen you?
	Reversal with any two auxiliaries: Has he been eating? Can he be sleeping? Couldn't he have gone?
5	Reversal with three auxiliaries: Could he have been going? Wouldn't he have been sleeping?

Interrogative Reversals require different rules for different verb forms. In the case of the copula, the verb is merely reversed with the subject: Is the boy here? Was he right? Are they your friends? Is it big? Other verb forms follow the rule that the subject is reversed with the first auxiliary: Is he coming? Can he come? Can he be coming? Has he been coming? Would he have been coming? If no auxiliary is in the original kernel sentence, the boy comes, then the obligatory do transformation supplies the necessary auxiliary, and the tense marker is transposed from the main verb to the do: The boy does come. Then the interrogative reversal can be performed: Does the boy come?

In Developmental Sentence Scoring the first group of interrogative reversals involved the copula, either present or past tense. The second group involved auxiliary be, present or past tense. The third group included three different interrogative forms: obligatory do, modal reversal, and the use of a tag question. The fourth group included reversals with auxiliary have, which was the last auxiliary to develop. The last group included reversals of the first auxiliary when the verb string was composed of three auxiliaries plus the lexical verb.

Questions were scored for the reversal transformation only. If the sentence happened to be negative as well, the negative item was scored in addition. Thus, the combining of many types of transformations into one sentence yielded a higher score, as the "transformational load" increased.

Wh-Questions

Score	Examples
1	who, what, what + noun: What do you want? Who is there? What book are you reading?
2	where, how many, how much, what...doing, what...for: Where is he? How many do you want? What are you doing? What is a hammer for?
3	when, how, how + adjective: When shall I come? How do you do it? How big is it?
4	why, what if, how come, how about + gerund: Why are you crying? What if I won't do it? How come he is crying? How about coming with me?
5	whose, which, which + noun: Whose car is that? Which do you want? Which book do you want?

The scoring of wh-questions involved the selection of the appropriate wh-word and its placement in the initial position in the sentence. The reversal of the subject and the first auxiliary is the same as for yes-no questions; therefore, wh-questions scored under two headings, wh-questions, for the choice of the wh-word, and the interrogative reversal for the subject-auxiliary reversal. Wh-words used as subjects do not require the reversal, who is there?, and some colloquial forms do not require the reversal, what if he comes? and how come you did that? These wh-forms scored only as wh-word choices, not as interrogative forms.

Scores for wh-questions increased largely on a semantic basis, the higher-scoring wh-words requiring more sophisticated concepts: differentiation of person and object (who, what); place (where); quantity (how many, how much); action (what...doing); purpose (what...for); time (when); manner (how, how big); causality (why, how come); probability (what if, how about); identification (whose, which, which book).

The Developmental Sentence Score (DSS)

With possible scores in each of the eight classifications of grammatical structure, a child's ability to handle the "transformational load" in spontaneous speech could be evaluated. Individual scores for the fifty-sentence speech sample were totaled and the mean score per sentence was derived. This number was called the Developmental Sentence Score (DSS).

Table 1 shows a sample score sheet with a miscellaneous set of scored sentences which illustrate some of the procedures just discussed. It includes some extremely immature sentences and some with a very heavy transformational load; it is doubtful that any real speech sample would ever contain such extremes. A comparison of sentences 1 through 9 reveals the increase of individual sentence scores as more transformations are added to the same kernel. A Developmental Sentence Score (DSS) of 11.23, which is the mean sentence score, has been derived from this hypothetical corpus to demonstrate the procedure.

Table 1. Hypothetical corpus of 30 sentences illustrating Developmental Sentence Scoring

		Indef. Pro.	Pers. Pro.	Prim. Verb	Sec. Verb	Neg.	Conj.	Inter. Rev.	Wh-Q	Sent. Point	Total
1.	Boy eat.			---						0	0
2.	Boy eat cookie.			---						0	0
3.	The boy is eating a cookie.			2						1	3
4.	The boys are eating cookies.			3						1	4
5.	They ate them.		3,3	3						1	10
6.	They didn't eat them.		3,3	5		4				1	16
7.	Didn't they eat them?		3,3	5		4		3		1	19
8.	Why didn't they eat them?		3,3	5		4		3	4	1	23
9.	Why didn't they?		3	inc.		4		3	4	1	15
10.	All the cookies were eaten.	2		7						1	10
11.	I want to eat some cookies	2	1	1	1					1	6
12.	I want him to eat some cookies.	2	1,2	1	4					1	11
13.	I tried to find some cookies.	2	1	3	4					1	11
14.	Could you find them?		1,3	5				3		1	13
15.	You couldn't find them, could you?		1,3	5		4		3		1	17
16.	Nobody knows where to find them	4	3	3	4		6			1	21
17.	Who knows where she keeps them?		2,3	3,3			6		1	1	19
18.	I looked but I couldn't find them.		1,1,3	3,5		4	2			1	20
19.	I like eating cookies.		1	1	6					1	9
20.	Nobody told me that I shouldn't eat them.	4	1,1,3	3,5		4	6			1	28
21.	I only ate a few.	6	1	3						1	11
22.	Somebody else must have eaten all the rest.	3,2		8						1	14
23.	Let's eat some more.	2,2		1	1					1	7
24.	Mommy said, "Don't eat those cookies."		4	3,4		2				1	14
25.	That isn't what she said.	1	6,2	1,3		3				1	17
26.	Him can't have some.	---	---	4		2				0	6
27.	What you eating?		1	---				---	1	0	2
28.	Her don't gots any.	5	---	---		---				0	5
29.	Mommy find out.			---						0	0
30.	You want to get spanked?		1	---	5			---		0	6
										Total:	337

337/30 = 11.23 DSS

RELIABILITY

A reliability check was made by 24 speech pathology students in a graduate level course in language development. After about eight hours of classroom presentation of the DSS procedure, each student was given a different tape, randomly selected from the research collection. Each student made his own transcription and selected his own corpus of the last fifty sentences for DSS scoring. The discrepancies between the students' scores and the research scores ranged from .62 above to .72 below, with a mean absolute discrepancy of .29 points, which represented an overall discrepancy of 3%. The investigator then scored the students' transcribed sentences to see whether the score discrepancies had occurred only in the transcribing or whether the scoring procedure itself had been misunderstood or misapplied. The discrepancies between the students' scores and the investigator's scores of the students' transcriptions ranged from .68 points above to .24 points below, with a mean absolute discrepancy of .19 points, which represented an overall discrepancy of 2%. Thus, while individual judgments were not in perfect agreement, the Developmental Sentence Scoring technique seemed to be a reliable procedure which could be learned and applied effectively by teachers and clinicians.

RESULTS

Using the Developmental Sentence Scoring technique, DSS scores were derived from the 50-sentence speech samples of each of the 160 children in the study. Mean DSS scores were then derived for boys and girls separately, divided into 6-month age groups, as shown in Table 2. Boys' scores were consistently lower than girls' except at the lowest age group. The gap appeared to widen with age and was greatest between ages 6-0 and 6-5. Both boys and girls showed a similar plateau in performance between ages 5-0 and 5-5.

Table 2. Mean DSS scores of 80 boys and 80 girls by 6-month age groups.

Age Group	Boys		Girls	
	N	DSS	N	DSS
3-0 to 3-5	10	6.40	10	6.19
3-6 to 3-11	10	6.49	10	6.87
4-0 to 4-5	10	7.05	10	7.75
4-6 to 4-11	10	7.86	10	8.46
5-0 to 5-5	10	8.37	10	9.66
5-6 to 5-11	10	8.25	10	9.52
6-0 to 6-5	10	9.05	10	10.88
6-6 to 6-11	10	10.36	10	11.54

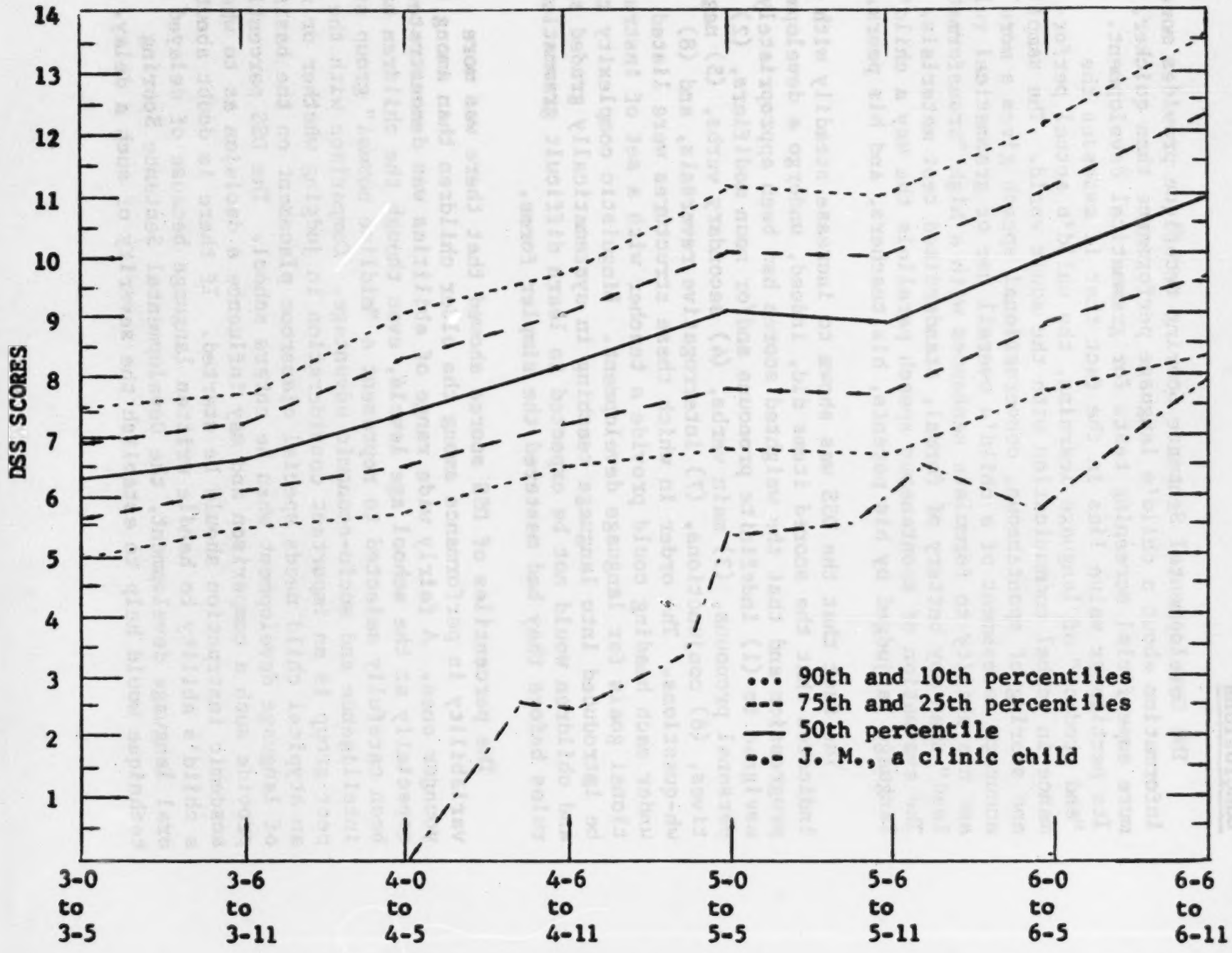
Percentiles were computed for the boys and girls combined by 6-month age groups. The score distributions within each age group were fitted to normal curves and percentile values were then computed from the normalized distributions. Table 3 shows these percentiles.

Table 3. Percentiles of DSS scores of 160 children, boys and girls combined, by 6-month age groups.

Age Group	N	10%ile	25%ile	50%ile	75%ile	90%ile
3-0 to 3-5	20	5.02	5.62	6.30	6.97	7.57
3-6 to 3-11	20	5.60	6.11	6.68	7.25	7.76
4-0 to 4-5	20	5.47	6.38	7.40	8.42	9.32
4-6 to 4-11	20	6.58	7.32	8.16	9.00	9.75
5-0 to 5-5	20	6.81	7.84	9.01	10.18	11.22
5-6 to 5-11	20	6.71	7.73	8.89	10.05	11.07
6-0 to 6-5	20	7.75	8.79	9.96	11.14	12.18
6-6 to 6-11	20	8.30	9.54	10.95	12.36	13.60

Figure 1 shows the progression of percentiles by 6-month age groups for the combined 160 children. At the upper age levels there was a much wider spread between the percentiles than there was at the lower age levels, indicating more diversity in grammatical performance among older children than among younger children. The usefulness of the DSS technique as a means for evaluating both the status and the progress of syntactic development in an atypical child is also illustrated in Figure 1. J. M. was a language-delayed child enrolled at the Northwestern University Speech Clinic when she was 3-8. She had an expressive vocabulary of only a few words, which she spoke in single-word utterances. As she underwent language development training, DSS scores were taken periodically to measure her progress. Her first recorded speech sample, taken at age 4-1, contained only one sentence, which scored 0. The next four speech samples contained less than 50 sentences; therefore, these first few DSS scores could be considered merely estimates of her syntactic development. From age 5-5 onward, her recordings contained many more than 50 sentences, from which an adequate corpus could be extracted, and these DSS scores could be considered reliable measures of her use of grammatical rules. By plotting J. M.'s successive DSS scores on the same chart as that for normal children, it could easily be seen that although she was considerably delayed in language performance, she was progressing at a faster than normal rate. Her entrance into first grade was postponed until she was past age 6-6, at which time her DSS of 7.92 was within normal limits of the 5-6 to 5-11 age group, who would be her peers in school.

Figure 1. Percentiles of DSS scores of 160 children by 6-month age groups compared with successive DSS scores of a clinic child.



CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The Developmental Sentence Scoring technique provides more information about a child's language performance than quicker, more superficial screening tests for grammatical development. Its particular value lies in the fact that it assesses the "end product" of language learning, the child's actual performance in verbal communication with the adult world. The sampling and scoring of spontaneous, conversational speech gives a more accurate assessment of a child's overall use of grammatical rules and his ability to formulate sentences with a high "transformational load" than any battery of formal, standardized test materials. The evaluation of spontaneous speech parallels the way a child's language is judged by his parents, his teachers, and his peers.

The fact that the DSS was shown to increase steadily with age indicates that the scored items did, indeed, undergo a developmental progression and that the weighted scores had been appropriately assigned to (1) indefinite pronouns and/or noun modifiers, (2) personal pronouns, (3) main verbs, (4) secondary verbs, (5) negatives, (6) conjunctions, (7) interrogative reversals, and (8) wh-questions. The order in which these structures were listed under each heading could provide a teacher with a set of instructional goals for language development. Linguistic complexity could be introduced into language teaching in systematically graded steps, and children would not be expected to learn difficult grammatical rules before they had mastered the simpler forms.

The percentiles of DSS scores showed that there was more variability in performance among the older children than among the younger ones. A fairly wide range of abilities was demonstrated, especially at the school age levels, even though the children had been carefully selected to represent a "midline normal" group of intelligence and socio-economic advantage. Comparison with the peer group is an important consideration in judging whether or not an atypical child needs special classroom placement on the basis of language development when he enters school. The DSS percentiles provide such a comparison and may influence a decision as to when academic instruction should be started. If there is doubt about a child's ability to handle written language because of delayed oral language development, the Developmental Sentence Scoring technique would help to establish the severity of such a delay.

Recommendations

The Developmental Sentence Scoring procedure would be appropriate in establishing accurate baselines for research in language development among various kinds of atypical children. By comparison with the DSS percentiles for normal children, it could be shown whether mentally retarded children were continuing to make gains even though they progressed at a much slower rate. The language development of hard-of-hearing children could be accurately compared to the hearing population of their own age group. Special Education programs, speech clinics, and other agencies concerned with atypical children could make use of this procedure. The Northwestern University Speech Clinic is routinely making DSS evaluations of the children enrolled for language development training and is including this item in clinical progress reports.

The Developmental Sentence Scoring procedure could be used to measure the comparative effectiveness of various teaching methods. Children who are given language instruction by means of programmed reinforcement methods could be compared with children who receive a more conversational approach to language training. The sampling and scoring of conversational speech would reveal the extent to which children could generalize the grammatical rules which they had learned in a programmed setting; it would identify children who had "passed the programs" but still made little use of grammatical rules in spontaneous speech.

Further research with the DSS should be done at both ends of the age groups already studied. The procedure should be tried out with children 2-0 to 2-11 and also beyond the 6-11 group. It would be interesting to know what kind of DSS would be achieved by adults and whether their language performances would vary according to different social situations. It would also be interesting to study the plateau demonstrated by both boys and girls in the 5-6 to 5-11 age group. It is possible that this group is attempting some of the more difficult transformational operations and that this reduction in overall score is not entirely indicative of regression in linguistic performance.

The Developmental Sentence Scoring procedure has many research possibilities, and its use should be encouraged both in schools and in clinics where the language development of atypical children is being studied. The fact that the reliability among different investigators was so high indicates that it is a procedure which can be learned and applied with confidence. The DSS procedure is being routinely taught to graduate students in the Department of Communicative Disorders at Northwestern University, and these students are continuing to use it in their professional settings elsewhere.

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